#21 Affidavit 7-31-03

Docket No. 005974/00011

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Boussac et al.
Serial No. : 09/329,889
Filed : June 10, 1999
Title : Swept Volume Model

Art Unit : 2123
Examiner : Thangavelu, K.

Commissioner for Patents
Washington, DC 20231

AFFIDAVIT OF FRANÇOIS PERROUX

FILED UNDER 37 C.F.R. 1.132

I, François PERROUX, affirm:

1. I am a PhD graduate of the Ecole Centrale des Arts et Manufactures, Paris, where I studied Mathematics, Physics and Mechanics and received a University Degree in Thermodynamics and Computer Science.

2. I have been employed by Dassault-Systèmes since 1984 in the field of computer aided design, manufacturing, and engineering (CAD/CAM/CAE) system development.

3. I have reviewed currently pending claims 25, 27-28, 30-31, 33-36, and 38 of U.S. Patent application No. 09/329,889 and have reviewed the specification of U.S. patent application No. 09/329,889 as originally filed with the United States Patent and Trademark Office on June 10, 1999 (the "Specification").

4. Pending claims 25, 27-28, 30-31, 33-36, and 38 of U.S. Patent application No. 09/329,889 each relate to the design and engineering of functionality of computer aided design, manufacturing, and engineering (CAD/CAM/CAE) systems and, in particular, to the design and implementation of swept volume functionality in a CAD/CAM/CAE system.

5. As more specifically set forth in the paragraphs that follow, the disclosure of U.S. Patent application No. 09/329,889 is sufficient to enable one to implement (i.e., make and use) the inventions recited in pending claims 25, 27-28, 30-31, 33-36, and 38 as of the time of filing of the Specification.

6. Claim 25 recites "A method for use in calculation of a swept volume of a computer generated model of a real-world object, the method comprising." The calculation of swept volumes is a known problem in the CAD/CAM/CAE design arts and this recitation is sufficiently clear to enable one skilled in the CAD/CAM/CAE design arts to understand the subject of the invention that is claimed.

7. Claim 25 further recites "generating a three dimensional polyhedral representation of the model of the real-world object, the representation comprising a plurality of polygons joined at their edges." I understand this recitation as referring to the use of tessellated representations of 3D virtual objects. The use of such objects is known in the CAD/CAM/CAE design arts and one familiar with the CAD/CAM/CAE design arts would know how to make and use such a representation.

8. Claim 25 further recites "representing three dimensional motion of the modeled object by a series of sequential positions of the modeled object in three dimensional space." I understand this recitation as referring to a sampling of the continuous movement of the object using a series of "small" sequential positions. Support for this element of claim 25 is found at page 5 ¶ 2 of the Specification, and is illustrated in the application figures. The aforementioned disclosure is sufficient to enable implementation of the claimed invention.

9. Claim 25 further recites "for each position in the series of sequential positions of the modeled object." I understand this recitation as meaning that the system will perform a series of subsequently identified processing steps in an incremental fashion. Such incremental processing is well known in the field of software design and one familiar with the CAD/CAM/CAE design arts would know how to implement an incremental processing step.

10. Claim 25 further recites "determining a subset of the edges such that each edge in said subset has a trajectory through a corresponding first zone in which motion of the corresponding edge comprises motion on the boundary of the modeled swept volume during motion of the modeled object from a current position to a next position." I understand this recitation as meaning that the claimed process includes identifying the edges of an object which will eventually draw the outer skin ("boundary" or "envelope") of the swept volume. This claim element is supported by disclosure found at page 6 ¶ 2 of the Specification and is also supported by Fig. 8 of the Specification. For example, traces 810 to 816 provide support for this claim element. The aforementioned disclosure is sufficient to enable implementation of the claimed invention.

11. Claim 25 further recites "where each such edge's corresponding first zone comprising a region external to the material of the modeled object and bounded by a planar extension of the polygons that join at said edge." I understand this recitation as meaning that the claimed invention includes examining small movements of the 3D object to determine whether edges of the 3D object enter two specific sectors in space. This claim element is supported by Fig. 7 of the Specification and is described from page page 7 line 29 till page 8 line 3, and in the flow chart in the 1016 to 1020 steps. The aforementioned disclosure is sufficient to enable implementation of the claimed invention.

12. Claim 25 further recites "determining a subset of the polygons such that each polygon in said subset has a trajectory through a corresponding second zone during motion of the modeled object from a preceding position to a current position and from the current position to a next position." I understand this recitation as meaning that the claimed invention includes a processing step to identify polygons which will contribute to build the swept volume envelope being computed. This claim element is supported by disclosure found at page 9 ¶ 3 of the Specification and in Fig. 10 as step 1023. The aforementioned disclosure is sufficient to enable implementation of the claimed invention.

13. Claim 25 further recites "where each such polygon's second zone comprises a zone represented by a half sphere, said half sphere comprising a flat face that is planar with said polygon and said half sphere extending interior to the modeled object." I understand this recitation as defining simple geometric shapes and defining particular geometric relationships between entities. This recitation is supported by disclosure found page 7 line 3 to 6, 18 to 20, and supported by Fig. 7, which shows a half sphere 510 with a flat face planar with the illustrated polygon and extending interior to the modeled object. The aforementioned disclosure is sufficient to enable implementation of the claimed invention.

14. Claim 25 further recites "generating a trace of the motion of said subset of edges between said current and said next positions." I understand this recitation as meaning that the edges, while they move from one position to the next incremental position, generate a "trace", that is a small face, which is made of polygons. This claim element is supported by disclosure found at page 5 ¶ 2, page 8 ¶ 5, and Fig. 10, steps 1018 and 1019 of the Specification. The aforementioned disclosure is sufficient to enable implementation of the claimed invention.

15. Claim 25 further recites "constructing a representation of the swept volume from the generated traces of the motion of said subset of edges." I understand this recitation as meaning that the claimed invention includes a step whereby the final swept volume is constructed using small faces. This claim element is supported by disclosure found at page 9 ¶ 2 of the Specification. The aforementioned disclosure is sufficient to enable implementation of the claimed invention.

16. Claim 25 further recites "wherein constructing a representation of the swept volume further comprises bounding the swept volume at each of said current positions in said series by said subset of polygons associated with each such current position." I understand this recitation as meaning that the claimed invention includes formation of a completed representation of the swept volume with using polygons determined in preceding steps, as disclosed on page 9, lines 18 to 20, and as illustrated in steps 1019, 1023 and 1026 from the flow chart. The

aforementioned disclosure is sufficient to enable implementation of the claimed invention.

17. In my opinion, the Specification (i.e., application No. 09/329,339, as filed with the USPTO on June 10, 1999), is sufficient to enable the implementation of each element of claim 25 at the time of filing of the Specification as recited in claim 25.

18. Claim 27 recites "The method of claim 25 wherein each of said plurality of polygons is a triangle." I understand this recitation as referring to the use of a triangle-based tessellated representations of a 3D virtual objects. The use of such objects is known in the CAD/CAM/CAE design arts and one familiar with the CAD/CAM/CAE design arts would know how to make and use such a representation.

19. Claim 28 recites "The method of claim 25 wherein the motion between two consecutive positions of the modeled object is modeled as linear motion." I understand this recitation as meaning that modeling of object movement can be done as a series of small linear motion (a "linear approximation"). The use of linear approximations of movement is known in the CAD/CAM/CAE design arts and one familiar with the CAD/CAM/CAE design arts would know how to implement the invention of claim 25 to include modeling using linear motion as recited in claim 28.

20. Claim 30 recites "The motion of claim 25 wherein the representation of sequential positions of motion comprise rotational and translational representations." I understand this recitation as meaning that the method works for movements combining rotations and translations. Rotational and translational movements are common in the CAD/CAM/CAE design arts and one familiar with the CAD/CAM/CAE design arts would know how to implement the invention of claim 25 to include rotational and translational movements as recited in claim 30.

21. I understand claim 31 as being directed to a computer system performing the method recited in claim 25. Claim 31 can be implemented based on the same

disclosure as would enable one to implement claim 25, and the Specification is sufficient to enable such an implementation.

22. Claim 33 recites "The computer system of claim 31 wherein the position matrices representing motion comprise motion data associated with a real-world object that is collected during physical experiments." I understand this recitation as meaning that the system of claim 31 can be applied to models of real objects (e.g., a car battery) that have to be moved in a particular way (e.g., by extracting the battery from an opening while keeping constraints related to the operator's arm length, flexibility, and strength). It is known in the CAD/CAM/CAE design arts to use data from physical experiments in the CAD/CAM/CAE process and one familiar with the CAD/CAM/CAE design arts would know how to implement the invention of claim 33.

23. Claim 34 recites "The computer system of claim 31 wherein each of said plurality of polygons is a triangle." I understand this recitation as referring to the use of a triangle-based tessellated representations of a 3D virtual objects. The use of such a representation is known in the CAD/CAM/CAE design arts and one familiar with the CAD/CAM/CAE design arts would know combine such a representation with the invention of claim 31 as recited in claim 34.

24. I understand claim 35 as reciting a software program implementation of the method of claim 25. Claim 35 can be implemented based on the same disclosure as would enable one to implement claim 25, and the Specification is sufficient to enable such an implementation.

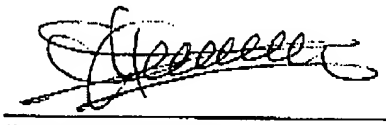
25. I understand claim 36 as recited a method for calculation of swept volume of a two-dimensional object. Claim 36 can be derived from claim 25 by reducing the dimensionality of the geometric elements. That is, faces become edges and edges become points. Such changes in dimensionality are understood by those skilled in the CAD/CAM/CAE arts. Furthermore, claim 36's recitation of the use of vertices to build a movement trace is disclosed in Fig. 8 of the Specification, and related text, which shows and explains the generation of trace edges 810 to 816. Claim

36's recitation of the use of edges to limit the swept volume of the generated trace is disclosed in Fig. 8 of the Specification which explains the movement of edges through a material zone represented by a half circle as recited by claim 36. The Specification is sufficient to enable one skilled in the art to implement the invention of claim 36.

26. Claim 38 recites "The method of claim 36 wherein the motion between two consecutive positions of the modeled object is modeled as linear motion." I understand this recitation as meaning that modeling of object movement can be done as a series of small linear motion (a "linear approximation"). The use of linear approximations of movement is known in the CAD/CAM/CAE design arts and one familiar with the CAD/CAM/CAE design arts would know how to implement the invention of claim 36 to include modeling using linear motion as recited in claim 38.

27. References herein to (i) knowledge of one skilled in the CAD/CAM/CAE arts, to (ii) one familiar with CAD/CAM/CAE arts, or (iii) the use of similar terms, refers to information known in the CAD/CAM/CAE arts at the time of filing of the Specification.

Subscribed and Sworn at Suresnes, France, on July 25, 2003.



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